SEP 13 2004

PETITION TO LIST PUGET SOUND STEELHEAD (ANADROMOUS *ONCORHYNCHUS MYKISS*) AS AN ENDANGERED OR THREATENED SPECIES UNDER THE ENDANGERED SPECIES ACT (ESA)

TO: SECRETARY OF COMMERCE, UNITED STATES DEPARTMENT OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL MARINE FISHERIES SERVICE.

From: Sam Wright (Petitioner), 2103 Harrison NW, Ste. 2126, Olympia, Washington, 98502 (Tel. 360-943-4424). Petitioner is a fish biologist with 42 years experience in managing fish populations and fish habitat and is Certified as a Fisheries Professional (CFP) by the American Fisheries Society.

Subject: Petition the Secretary of Commerce to list as Endangered or Threatened the Puget Sound populations of steelhead (anadromous *Oncorhynchus mykiss*) and to designate critical habitat. These same populations were previously evaluated for ESA listing in the following report:
Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-NWFSC-27, 261 p.

The report, herein defined as Busby et al. (1996), defined an Evolutionarily Significant Unit (ESU) for Puget Sound steelhead populations but did not recommend ESA listing based on scientific evidence available at the time of report preparation. The most recent quantitative population assessment data including in the report for Puget Sound steelhead was for 1994 (Busby et al. 1996, Appendix E). At the time, the short term (five year) abundance trends for eleven defined populations were significantly different from zero (9 negative, 2 positive). The two positive trends were both for portions of the Snohomish river basin (Snohomish/Skykomish and Pilchuck River). The two largest river basins (Skagit and Snohomish) had short term increasing trends but neither were significantly different from zero. *There was not a single entire river basin, large or small, that had a significant upward short-term trend in steelhead abundance.* There are now ten years of additional population assessment data for Puget Sound steelhead and nearly all of the river systems now have distinct downward trends in population abundance and are not even coming close to replacing themselves from generation to generation on a one-to-one basis. In addition, there is currently a complete ban on the retention of wild steelhead (defined as fish with an adipose fin) by recreational anglers in all river systems within the Puget Sound Basin (Note: a one fish annual limit was recently enacted for naturalized or non-indigenous Green River summer run steelhead). Based on this new scientific evidence, a re-examination of the original ESA listing decision is warranted for Puget Sound steelhead. Petitioner believes that Puget Sound steelhead now clearly qualify for ESA listing as Threatened.

Basis for the Petition

Section 4 of the ESA contains provisions allowing interested persons to petition the Secretary of Commerce or the Secretary of Interior to add a species to, or remove a species from, the List of Endangered or Threatened Wildlife. Petitioner files this petition under the Endangered Species Act, 16 U.S.C. section 1531-1543 (1982), its implementing regulations, 50 C.F.R. part 424, and the Administrative Procedures Act, 5 U.S.C. section 553 ©. The National Marine Fisheries Service (NMFS) has jurisdiction over this petition under 16 U.S.C. section 1533 (a) and the August 26, 1974 Memorandum of Understanding Between the U.S. Fish and Wildlife Service and National Marine Fisheries Service Regarding Jurisdictional Responsibilities and Listing Procedures Under the Endangered Species Act of 1973.

Basis for the ESU Determination

Busby et al. (1996:58-59) provide the following justification for the Puget Sound steelhead ESU:

"**1) Puget Sound**—This coastal steelhead ESU occupies river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington. Included are river basins as far west as the Elwha River and as far north as the Nooksack River.

No recent genetic comparisons have been made of steelhead populations from Washington and British Columbia, but samples from the Nooksack River differ from other Puget Sound populations, and this may reflect a genetic transition zone or discontinuity in northern Puget Sound. In life history traits, there appears to be a sharp transition between steelhead populations from Washington, which smolt primarily at age 2, and those in British Columbia, which commonly smolt at age 3. This pattern holds for comparisons across the Strait of Juan de Fuca as well as for comparisons for Puget Sound and Strait of Georgia populations. At the present time, therefore, evidence suggests the northern boundary for this ESU coincides approximately with the U.S.-Canada border.

Recent genetic data provided by WDFW show that samples from the Puget Sound area generally form a coherent group, distinct from populations elsewhere in Washington. There is also evidence for some genetic differentiation between populations from northern and southern Puget Sound, but the BRT did not consider that ecological or life history differences were sufficient to warrant subdividing this ESU. Chromosomal studies show that steelhead from the Puget Sound area have a distinctive karyotype not found in other regions.

The Puget Sound region is in the rain shadow of the Olympic Mountains and therefore is drier than the Olympic Peninsula; most of the Puget Sound region averages less than 160 cm of precipitation annually, while most areas of the Olympic Peninsula exceed 240 cm (Jackson 1993). Climate and river hydrology change west of the Elwha River (see Weitkamp et al. 1995). The rivers in Puget Sound generally have high relief in the headwaters and extensive alluvial floodplains in the lowlands. Geology and topography are dominated by the effects of the Cordilleran Ice Sheet as evidenced by glacial deposits and the regional geomorphology.

Puget Sound's fjord-like structure may affect steelhead migration patterns; for example, some populations of coho and chinook salmon, at least historically, remained within Puget Sound and did not migrate to the Pacific Ocean itself (Wright 1968, Williams et al. 1975, Healey 1980). Even when Puget Sound steelhead migrate to the high seas, they may spend considerable time as juveniles or adults in the protected marine environment of Puget Sound, a feature not readily accessible to steelhead from other ESUs.

Most of the life history information for this ESU is from winter-run fish. Apart from differences with Canadian populations noted above, life history attributes of steelhead within this ESU (migration and spawn timing, smolt age, ocean age, and total age at first spawning) appear to be similar to those of other west coast steelhead. Ocean age of Puget Sound summer steelhead varies among populations; for example, summer steelhead in Deer Creek (North Fork Stillaguamish River Basin) are predominately age-1-ocean, while those in the Tolt River (Snoqualmie River Basin) are most commonly age-3-ocean (WDF et al. 1993).

The Puget Sound ESU includes two stocks that have attracted considerable public attention recently: Deer Creek summer steelhead (North Fork Stillaguamish River Basin) and Lake Washington winter steelhead. Deer Creek summer steelhead were petitioned for listing under the ESA (Washington Trout 1993), but NMFS determined that this population did not by itself represent an ESU (NMFS 1994b). Adult Lake Washington winter steelhead have experienced a high rate of predation by California sea lions (*Zalophus californianus*) below the fish ladder at Hiram M. Chittenden Locks (also known as the Ballard Locks), the artificial outlet of Lake Washington. Deer Creek summer steelhead and Lake Washington winter steelhead were 2 of the 178 stocks identified in the west coast steelhead petition (ONRC et al. 1994).

This ESU is primarily composed of winter steelhead but includes several stocks of summer steelhead, usually in subbasins of large river systems and above seasonal hydrologic barriers. Nonanadromous *O. mykiss* co-occur with the anadromous from in the Puget Sound region; however, the relationship between these forms in this geographic area is unclear."

Assessment in 2004: There does not appear be any compelling recent information from the past ten years that would justify a re-examination of the Puget Sound steelhead ESU defined above.

Artificial Propagation

Busby et al. (1996:74) first defined two steelhead broodstocks of relevance to the Puget Sound ESU:

"**Chamber Creek winter steelhead**—This stock of winter steelhead comes from Chambers Creek, Tacoma, Washington and was first cultured in the 1920s (Crawford 1979). Chambers Creek steelhead have been introduced throughout western Washington, including the Puget Sound region, and in tributaries of the lower Columbia River. As much as 90% of steelhead harvested from some western Washington streams can be attributed to Chambers Creek winter steelhead, through artificial and established natural production (Crawford 1979, WDF et al. 1993). Concerns over genetic introgression into native stocks by Chambers Creek steelhead led to attempts to establish native brood stocks in Washington (Crawford 1979); however, the Chambers Creek steelhead stock is still considered essential to most of Washington winter steelhead operations (Huew et al. 1990, WDF et al. 1993).

Skamania summer steelhead—Skamania summer steelhead were developed from Washougal and Klickitat River summer steelhead in the late 1950s at the Skamania Hatchery, Washington (Crawford 1979). This stock has been widely used in Washington, Idaho, Oregon, California, Indiana, Rhode Island, and North Carolina (Crawford 1979, CDFG 1994). In many cases, Skamania stock have been introduced where summer steelhead did not naturally exist, to provide recreational angling opportunities, for example, the Willamette River. Additionally, Skamania stock have been introduced in river basins having endemic summer steelhead populations, such as the Stillaguamish and Columbia River tributaries."

Busby et al. (1996:76) then went on to describe the artificial propagation program:

"1) **Puget Sound**—Artificial propagation of steelhead in the range of the Puget Sound ESU is pronounced (Fig. 10). About 1,500,000 winter steelhead and 400,000 summer steelhead, mostly smolts, are released annually into river basins in this area (WDF et al. 1993, WDFW 1994a). Hatchery programs in the Puget Sound region largely rely on Chambers Creek winter steelhead and Skamania-stock summer steelhead (Crawford 1979, Huew et al. 1990). The abundance of hatchery winter steelhead in Puget Sound results in a target harvest rate of 90% (WDF et al. 1993). Most Skamania-stock summer steelhead are introduced into streams not previously utilized by summer steelhead, although this stock is also routinely planted in streams containing indigenous Puget Sound summer steelhead, such as the Skagit, Stillaguamish, and Snohomish River systems (Crawford 1979). The Nisqually River is the only major river in Puget Sound not receiving hatchery winter steelhead (WDF et al. 1993); however, this river is planted with about 24,000 Skamania-stock summer steelhead per year (WDFW 1994a)."

Assessment in 2004: There have been significant changes in the status situation described above. There has been a significant increase in the overall numbers of hatchery steelhead smolts released (as stated in the recent Hatchery and Genetic Management Plans or HGMPs required by NMFS). Seemingly, this would have been countered by the significant decline in hatchery smolt to adult survival rates. However, the declining status of wild runs indicates that both the abundance and survival rates of wild fish have also declined. The production of wild smolts has undoubtedly decreased, although their numbers are not enumerated on a consistent basis in any major Puget Sound river system (in contrast to the contemporary situation for chinook and coho salmon in Puget Sound). Coho salmon smolts continue to dominate (over 90%) in all juvenile trapping assessments of yearling (or older) salmonids in smaller streams (with total trapping capabilities and generally adequate adult spawning escapements) such as Big Beef and Bingham creeks (D. Seiler, WDFW, personal communication). Note: Big Beef Creek is a direct tributary to saltwater on the Kitsap Peninsula, while Bingham Creek is a Satsop River tributary with an average rainfall more typical of Puget Sound. Any such comparisons on Snow Creek, a long-term steelhead research stream, cannot be made due to inadequate coho spawners. A failure by the management entities to enumerate steelhead smolt production from a number of representative Puget Sound river systems is a critical error in judgment. Spawner-recruit relationships can only be developed from adults to adults, independent variables of freshwater and marine survival cannot be isolated, and the resultant adult to adult relationships have too much variability to provide sound resource management (Wright, S. 2003. A spawning escapement objective methodology for chinook salmon, coho salmon and steelhead trout: maximum sustainable smolt production (MSSP). Prepared for Washington Trout, Duvall, WA.).

Prelude to a Determination of Extinction Risk

Busby et al. (1996:94 (2 paragraphs) and 104) provide two key paragraphs prior to their determination of extinction risk for Puget Sound steelhead:

"One type of genetic change in hatchery population—advancement of run timing—is particularly relevant to west coast steelhead because it is a commonly used management strategy, particularly in Washington state. The logic behind this strategy is that displacing the run timing of hatchery fish from natural populations will reduce the possibility for genetic interactions between hatchery and natural fish and will allow for selective harvest of hatchery fish. For coastal steelhead in Washington, WDFW has provided information indicating substantial separation in peak run timing between hatchery and natural winter steelhead, and this pattern may occur in other coastal areas as well. However, run timing separation is seldom complete, and WDFW has found genetic evidence for substantial hatchery introgression in several winter steelhead populations (Phelps et al. 1994; see discussion under Steelhead Genetics, page 37). This issue is discussed further below under Approach to Risk Assessment (see page 103)." (page 94)

"Most Pacific salmonid stocks south of British Columbia have been affected by changes in ocean production that occurred during the 1970s (Pearcy 1992, Lawson 1993). Cooper and Johnson (1992) described a widespread decline in both natural and hatchery steelhead production since 1985, extending from British Columbia through Oregon. They attributed this decline largely to ocean factors but did not identify specific effects. However, climate conditions are known to have changed recently in the Pacific Northwest and much of the Pacific coast has also been experiencing drought conditions in recent years, which may have depressed freshwater production. We do not know whether these climate conditions represent a long-term shift in conditions which will continue affecting stocks into the future, or whether they indicate short-term environmental fluctuations which may be reversed in the near future."(page 94)

"In reviewing the status of individual ESUs of west coast steelhead, we considered the risks posed by artificial propagation to be important, particularly in combination with other risk factors indicating declines in abundance. Information submitted to the ESA Administrative Record for West Coast Steelhead indicates that, in general, the current WDFW policy to encourage run and spawn time separation between hatchery and natural winter steelhead and to maintain very high (80-90%) harvest rates on hatchery steelhead has resulted in less overlap on the natural spawning grounds than is the case for winter steelhead in Oregon. This factor was a consideration in the BRT's conclusions that some of the ESUs for steelhead in Washington state are not at risk of extinction or endangerment (see below). However, BRT conclusions on this issue should be regarded as preliminary because information about the degree of interactions that actually occur between hatchery and natural fish is still incomplete." (page 104)

Assessment in 2004: In the first paragraph, it is important to remember that "WDFW has found genetic evidence for substantial hatchery introgression in several winter steelhead populations". Subsequent narrative in Busby et al. (1996), for example, the third paragraph above, tend to treat this as a problem of "unknown" magnitude or importance but it would be hard to find anything more compelling than direct genetic evidence on introgression. Their document is inconsistent in the consideration of this critical issue. As the third paragraph states, it was a factor in deciding that the Puget Sound ESU was "not at risk of extinction or endangerment".

The second paragraph discusses both ocean conditions and freshwater climate conditions as possible causes of the general widespread declines in steelhead populations. However, there were apparently no quantified relationships of any kind available between steelhead abundance and environmental conditions. A number of more recent articles (post-1994) have examined the relationships between Pacific salmon and ocean conditions. The most frequently cited is Hare et al. (1999). (Hare, S.R., N.J. Mantua, and R.C. Francis. 1999. Inverse production regimes: Alaska and West Coast Pacific salmon. Fisheries 24(1):6-14.) However, Hare et al. (1999:12) conceded that "interannual variability appears to be more pronounced, in relation to interdecadal variability, in chinook and chum." There is no mention of steelhead and their supposed relationship for Pacific salmon is really a relationship for and driven by data from pink, sockeye, and coho salmon. In addition, catch is used consistently as a surrogate for abundance and several data elements such as "Washington sockeye" represent a double counting of fish from another jurisdiction (in this case Canada). Other scientists examining ocean survival have used a similar data base as Hare et al. (1999) and their published results reflect these same problems.

Analysis of Biological Information

Busby et al. (1996:104-105, 109) provided an analysis of biological information for the ESU:

"**1) Puget Sound**—Previous assessments of steelhead within the range of this ESU have identified several stocks as being at risk or of concern. Nehlsen et al. (1991) identified nine stocks as at some degree of risk or concern (Table 9). WDF et al. (1993) considered 53 stocks within the ESU, of which 31 were considered to be of native origin and predominately natural production. Their assessment of these stocks was 11 healthy, 3 depressed, 1 critical, and 16 unknown. Their assessment of the remaining (not native/natural) stocks was 3 healthy, 11 depressed, and 8 unknown (Appendix E).

No estimates of historical (pre-1960s) abundance specific to the Puget Sound ESU are available. Total run size for Puget Sound in the early 1980s can be calculated from estimates in Light (1987) as approximately 100,000 winter steelhead and 20,000 summer steelhead. Light provided no estimate of hatchery proportions specific to Puget Sound streams, but for Puget Sound and coastal Washington combined, he estimated that 70% of steelhead in ocean runs were of hatchery origin. The percentage in escapement to spawning grounds would be substantially lower due to differential harvest and hatchery rack returns.

Recent 5-year average natural escapements for streams with adequate data range from less than 100 to 7,200, with corresponding total run sizes of 550-19,800 Table 10). Total recent run size for major stocks in this ESU was greater than 45,000, with total natural escapement of about 22,000. The geographic distribution of escapement is illustrated in Figure 19.

There are substantial habitat blockages by dams in the Skagit and Elwha River Basins, and minor blockages, for example, impassable culverts, throughout the region. The Washington State salmon and steelhead stock inventory (SASSI) (WDF et al. 1993) appendices note habitat problems, including flooding, unstable soils, and poor land management practices, for most stocks in this region. In general, habitat has been degraded from its pristine condition, and this trend is likely to continue with further population growth and resultant urbanization of the Puget Sound region. Because of their limited distribution in upper tributaries, summer steelhead appear to be at more risk from habitat degradation than are winter steelhead.

Of the 21 independent stocks for which we had adequate adult escapement information to compute trends (Appendix E), 17 have been declining and 4 increasing during the available data series, with a range from 18% annual decline (Lake Washington winter steelhead) to 7% annual increase (Skykomish River winter steelhead). Eleven of these trends (9 negative, 2 positive) were significantly different from zero. Note that these trends are for the late run wild component of the winter steelhead populations; no adult trend data are available for summer steelhead. In addition, most of these trends are based on relatively short data series and may be influenced by recent climate conditions. The two basins producing the largest numbers of steelhead (Skagit and Snohomish Rivers) both have overall upward trends. Trends for individual river basins are summarized in Table 10 and Figure 20.

Hatchery fish are widespread, spawn naturally throughout the Puget Sound region, and are largely derived from a single stock (Chambers Creek). The proportion of spawning escapement comprised of hatchery fish ranged from less the 1% (Nisqually River) to 51% (Morse Creek). In general, hatchery proportions are higher in Hood Canal and the Strait of Juan de Fuca than in Puget Sound proper (Table 10). Most hatchery fish in this region originated from stocks indigenous to the ESU, but they are generally not native to their local river basins. WDFW has provided information supporting substantial temporal separation between hatchery and natural winter steelhead in this region. Given the lack of strong trends in abundance of the major stocks and the apparent limited contribution of hatchery fish to production of late-run winter stocks, most winter steelhead stocks in the Puget Sound ESU appear to be self-sustaining at this time. However, there are clearly isolated problems with sustainability of some steelhead runs in this ESU, notably with Deer Creek summer steelhead (although juvenile abundance for this stock increased in 1994) and with Lake Washington winter steelhead. Summer steelhead stocks within this ESU are all small, occupy limited habitat, and in most cases are subject to introgression by hatchery fish. While there are few data to access the status of these summer runs, there is cause for concern regarding their sustainability.

At present, the major threat to genetic integrity for Puget Sound steelhead comes from past and present hatchery practices. Risk factors relating to hatchery practices were discussed previously in the Background section."

Assessment in 2004: In the next to last paragraph, it should have been stated that "Most hatchery fish in this region *for winter-run steelhead* originated from *a single stock - Chambers Creek* - indigenous to the ESU" (not stocks). Chambers Creek is a small independent tributary to Puget Sound. Most of the summer-run steelhead hatchery fish originated from the non-indigenous Skamania stock.

Prelude to Conclusions

Busby et al. (1996:164) provide two key paragraphs in advance of making their conclusions on the Puget Sound steelhead ESU:

"The other ESUs (those not judged to be in danger nor likely to become so) are generally distinguished by three characteristics. First, although population abundance in these ESUs may be below historical levels, naturally reproducing steelhead still occupy most of the historical range in numbers that are sufficient to avoid most small-population risk problems. Second, while trends in the past few years may be downward, we did not find evidence that natural populations have failed to maintain themselves over longer time spans. Third, hatchery production does not appear to pose a major genetic risk to the natural populations in these ESUs, either because the level of hatchery production is relatively low or because there is evidence of substantial reproductive isolation between hatchery and natural populations.

Several factors relating to the status of steelhead populations were of substantial concern in all ESUs. Population trends since the mid-1980s have been downward in almost all ESUs. While this may reflect recent changes in regional climate patterns, it is unclear whether climate change is the sole cause of declines. It is also unclear if and when climate conditions may improve. Widespread degradation of both freshwater and estuarine habitats within the region is a concern, as are the potential results of continuing habitat destruction. The widespread production of hatchery fish raises concern for genetic integrity in most ESUs and is also of concern in determining the sustainability of natural production. Although in most cases available data are not sufficient to tell whether hatchery fish are having a strong negative impact on naturally produced steelhead, competition with introduced stocks for limited habitat could mask problems with the sustainability of natural stocks. Finally, many of the conclusions for specific ESUs involve a substantial degree of uncertainty resulting from a lack of information on population abundance, trends, resident fish, and interactions between hatchery and natural fish."

Assessment in 2004: The third distinguishing characteristic in the first paragraph is contradicted by a number of statements in the report concerning the definitive evidence of genetic introgression as reported to NMFS by WDFW in Phelps et al. (1994).

Steelhead ESU Conclusions

Busby et al. (1996:165) made these conclusions for Puget Sound steelhead:

"1) Puget Sound—The BRT concluded that the Puget Sound steelhead ESU is neither presently in danger of extinction nor is likely to become endangered in the foreseeable future. Despite this conclusion, the BRT has several concerns about the overall health of this ESU and about the status of certain stocks within the ESU. Recent trends in stock abundance are predominately downward, although this may be largely due to recent climate conditions. Yet trends in the two largest stocks (Skagit and Snohomish Rivers) have been upward.

The majority of steelhead produced within the Puget Sound region appear to be of hatchery origin, but most hatchery fish are harvested, and estimates of hatchery fish escaping to spawn naturally are all less than 15% of total natural escapement, except for the Tahuya and Morse Creek/Independents stocks where the hatchery proportion is approximately 50%. We are particularly concerned that the majority of hatchery production originates from a single stock (Chambers Creek), which could increase genetic homogenization of the resource despite management efforts to minimize introgression of the hatchery gene pool into natural populations via separation of hatchery and natural run timing and high harvest rates focused on hatchery runs.

The status of certain stocks within the ESU is also of concern, especially the depressed status of most stocks in the Hood Canal area and the steep declines of Lake Washington winter steelhead and Deer Creek summer steelhead.

These conclusions are tempered by two substantial uncertainties. First, there is very little information regarding the abundance and status of summer steelhead in the Puget Sound region. Although the numbers of summer steelhead have historically been small relative to winter steelhead, they represent a substantially different life history strategy and loss of these fish would diminish the ecological and genetic diversity of the entire ESU. Second, there is uncertainty regarding the degree of interaction between hatchery and natural stocks. Although WDFW's conclusion that there is little overlap in spawning between natural and hatchery stocks of winter steelhead throughout the ESU is generally supported by available evidence, for many basins it is based largely on models and assumptions regarding run timing rather than empirical data."

Assessment in 2004: In the first paragraph, it is incorrect to state that trends for the two largest stocks have been upward since both trends were not significantly different than zero.

New Information on the Status of Puget Sound Steelhead

The most relevant quantitative information now available regarding the status of Puget Sound steelhead is long-term run reconstruction data (see attachments for all Puget Sound river systems where these data are available - as provided by the Washington Department of Fish and Wildlife). Long-term records of estimated spawning escapements are now of somewhat limited value by themselves since the widespread retention fisheries of the past have now been replaced by a complete ban on any retention of wild Puget Sound steelhead by recreational anglers (except non-indigenous Green River summer-run fish). In addition, Treaty Indian catches of wild steelhead have been reduced to very low levels in most Puget Sound river systems. These types of records (i.e., escapements alone) should be viewed with caution in any attempts at trend analysis. From the much more suitable run reconstruction information, it is clear that there has been a dramatic status change in the past ten years. Busby et al. (1996) only had information through 1994. On an entire river basin basis, these showed either a significant short-term downward trend or a short-term trend that was not significantly different than zero. A decade later in 2004, it can now be seen that there are significant short- and long-term downward trends in nearly all river systems where run reconstruction data are available. In terms of extinction risk, it can now be seen what the potential future status of the resource will be if these same downward trends continue into the foreseeable future. In addition, the potential problems with "small numbers" or depensatory mortality have already arrived for nearly all of the Puget Sound steelhead populations (Wright, S. 2003. A critical flaw in the American Fisheries Society initiative to protect marine, estuarine, and diadromous fish stocks: failure to account for depensation. Prepared for Center for Biological Diversity, Oakland, CA.).

The structure of the Puget Sound steelhead ESU has undergone some drastic changes in the past decade. Four entire geographic regions - Juan de Fuca Strait, Bellingham Bay, Hood Canal, South Puget Sound - are now approaching functional extinction with no recent runs being large enough to be resistant to adverse environmental conditions and depensatory mortality risks in the future. There is now only one river system, the Skagit, with a steelhead population large enough to appear somewhat resistant to both adverse environmental conditions and potential depensatory mortality risks. The Green River system is now isolated from the Snohomish since the anadromous form of *O. mykiss* has become functionally extinct in the large Lake Washington-Lake Sammamish system. Natural steelhead spawning escapements to the Cedar River have been well less than 100 fish in several recent years and wild steelhead have completely disappeared in all other Lake Washington-Lake Sammamish tributary streams (Marshall, A.R., M. Small, and S. Foley. 2004. Genetic relationships among anadromous and non-anadromous *Oncorhynchus mykiss* in Cedar River and Lake Washington - implications for steelhead recovery planning. Washington Department of Fish and Wildlife, Olympia, WA.). Marshall et al. (2004) also described a serious problem involving hybridization with *O. clarki* which even extended to an inability to visually identify the two species. It now appears that a significant number of the fish considered to be steelhead by Busby et al. (1996) were actually hybrids or *O. clarki* (Ostberg, C.O., and R.J. Rodriguez. 2002. Novel molecular markers differentiate *Oncorhynchus mykiss* (rainbow trout and steelhead) and the *O. clarki* (Cutthroat trout) subspecies. Molecular Ecology Notes 2:197-202.).

The past decade has also been one of significant growth in artificial production programs for Puget Sound steelhead so that the dominance of hatchery fish over wild steelhead (as both juveniles and adults) has become much more pronounced in terms of potential adverse consequences. Myers et al. (2004:1980) summarized the expected problems as follows:

"Inevitably, hatchery brood stock show domestication effects, genetic adaptations to hatchery environments that are generally maladaptive in the wild. Hatchery fish usually have poor survival in the wild and altered morphology, migration, and feeding behavior (7). On release, hatchery fish, which are typically larger, compete with wild fish (1). Their high local abundance may mask habitat degradation, enhance predator populations, and allow fishery exploitation to increase, with concomitant mortality of wild fish (1,8). The absence of imprinting to the natal stream leads to greater straying rates, and this spreads genes not adapted locally (1). Also, hybrids have poor viability, which may take two generations to be detected (9)." (Myers, R.A., S.A. Levin, R. Lande, F.C. James, W.W. Murdoch, and R.T. Paine. 2004. Hatcheries and endangered salmon. Science 303:1980.)

In addition, hatchery steelhead present their own unique set of problems. For example, there is a well known serious problem with significant numbers of hatchery juveniles not migrating rapidly seaward as intended and becoming stream residents for an extended period of time (McMichael, G.A., C.S. Sharpe, and T.N. Pearsons. 1997. Effects of residual hatchery-reared steelhead on growth of wild rainbow trout and spring chinook salmon. Transactions of the American Fisheries Society 126:230-239. Viola, A.E., and M.L. Schuck. 1995. A method to reduce abundance of residual hatchery steelhead in rivers. North American Journal of Fisheries Management 15:488-493.). The problems with these residual hatchery steelhead include not only competition but predation on newly emergent wild steelhead fry. Note: These same hatchery steelhead also prey on listed Puget Sound chinook.

In recent years, there have been a number of reported observations of early-run hatchery steelhead males holding over in freshwater for an extended period of time and then spawning with late-run, fresh wild female steelhead (personal communication, Bill McMillan, Washington Trout). Unlike Pacific salmon, this appears to be the primary mechanism in steelhead that "spreads genes not adapted locally". Obviously, the problem has become more acute in recent years as the ratio between wild and hatchery steelhead has shifted significantly to the latter. Perhaps the most compelling unique adverse feature with hatchery steelhead is that experienced harvest managers commonly exclude hatchery origin spawners in their work with spawner-recruit relationships.

Assessment of Viability

The viability of the Puget Sound steelhead ESU is characterized by the health, abundance, productivity, spatial structure, and genetic/behavioral diversity of the individual populations within the ESU (McElhany et al. 2001). An ESU with a greater abundance of productive populations will be more tolerant to environmental variations, catastrophic events, genetic processes, demographic stochasticity, ecological interactions, and other processes than one with a single or few populations. In the Puget Sound steelhead ESU, there is now only the Skagit river system with a population that might merit the title of "productive" and even this has shown a significant recent decline in abundance that, if not reversed, could lead to its extirpation.

An ESU that is distributed across a variety of well-connected habitats can better respond to environmental perturbations, including catastropic events, than ESUs in which connectivity between populations has been restricted or lost. Genetic and behavioral diversity and the maintenance of local adaptations within an ESU allow for the exploitation of a wide array of environments, protect against short-term environmental changes, and provide the raw material for surviving long-term environmental change. The Puget Sound steelhead ESU no longer has productive steelhead populations in a wide expanse of geographic area including Juan de Fuca Strait, Bellingham Bay, Hood Canal and South Puget Sound tributaries. The geographic expanse of the currently viable Puget Sound steelhead ESU has been dramatically reduced in the past decade from the north, west and south. The connectivity between the Green and Snohomish populations has been lost due to a functional extinction of the anadromous life history strategy in the Lake Washington-Lake Sammamish system (which lies between the two). The new problems and losses described above are *all additive* to those population risk factors already documented by Busby et al. (1996).

The large-scale hatchery steelhead programs within the Puget Sound ESU do not offer a single potential benefit of any conceivable form (Wright, S. 2004. Comments on: Endangered and threatened species: Proposed policy on the consideration of hatchery-origin fish in endangered species act listing determinations for Pacific salmon and steelhead.). The hatchery programs for the predominant winter-run life history strategy are based primarily on the Chambers Creek stock that is not indigenous to any one of the larger Puget Sound river systems. Summer-run hatchery steelhead were derived mainly from the Skamania stock in the Columbia River system. The known hatchery steelhead impacts are all negative, including the increasing and widespread introduction of genetic material that is not locally adapted, competition with wild fish as both juveniles and adults, and predation on newly emergent wild steelhead fry by intended hatchery steelhead smolts that instead become temporary or permanent freshwater residents.

In view of the facts cited and presented in this petition, *the Puget Sound steelhead ESU is in danger of extinction throughout all or a significant portion of its range or is likely to become so in the foreseeable future.*